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Fatigue in an adult ADHD population: a trans-diagnostic approach

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Abstract

Objectives

Trans-diagnostic approaches suggest that key cognitive and behavioural processes maintain symptoms across a wide range of mental health disorders. Fatigue is a common clinical feature of Attention Deficit Hyperactivity Disorder (ADHD) in adulthood; however empirical data supporting its prevalence is lacking. This study aims to collate outcomes from outpatient services to 1) investigate the prevalence of fatigue in adults with ADHD, 2) examine symptoms of ADHD in adults with Chronic Fatigue Syndrome (CFS) and 3) consider secondary clinical characteristics common to both disorder groups.

Methods

Measures of self-reported fatigue were compared across groups of adults with ADHD ($N = 243$), CFS ($N = 86$) and healthy controls ($N = 211$) using a between-subjects cross-sectional design. Groups were also compared on secondary clinical measures of functional impairment, mood, anxiety, sleep, self-efficacy and their beliefs about the acceptability of expressing emotions.

Results

The ADHD group were significantly more fatigued than healthy controls with 62% meeting the Chalder et, al. (2013) criteria for fatigue caseness. ADHD symptomology was significantly greater in the CFS group than healthy controls. ADHD and CFS groups did not differ significantly on measures of functional impairment, mood and self-efficacy. No significant differences were detected on measures of anxiety when items relating to physical restlessness were removed from the analysis.

Conclusions

Adults with ADHD experience greater fatigue than healthy controls. Adults with CFS and ADHD share many trans-diagnostic clinical characteristics, including difficulties with low mood, anxiety and reduced self-efficacy which impact upon their overall functioning. Further research is required to investigate extraneous factors mediating fatigue severity in these clinical groups.

Practitioner Points

- Fatigue is a common clinical feature of ADHD in adulthood
- Evidenced-based interventions for CFS could be adapted to address fatigue in adults ADHD

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterised by behavioural symptoms of inattention, hyperactivity and impulsivity present before the age of 12 (DSM-5; American Psychiatric Association, 2013). Prevalence rates of ADHD in adulthood are estimated at 3.5% cross-nationally (de Graaf et al., 2008) and associated with moderate to severe levels of functional impairment in academic (Birchwood & Daley, 2012), occupational (Biederman et al., 2006; Halmøy, Fasmer, Gillberg, & Haavik, 2009) and social domains (Ramirez et al., 1997; Sacchetti & Lefler, 2014; Shaw-Zirt, Popali-Lehane, Chaplin, & Bergman, 2005).

Coping with ADHD in adulthood can be cognitively demanding as considerable mental effort is required to ignore environmental distractors, sustain attention, control impulsive urges and manage internal restlessness (Barkley, 2014). Many have experienced chronic underachievement and continuous negative feedback from others due to difficulties with symptom management (Young, Braham, Gray & Rose, 2007). As a result, reports of low self-esteem and reduced self-efficacy are common in adulthood (Knouse & Safren, 2010; Newark, Elsasser, & Stieglitz, 2016; Tabassam & Grainger, 2002; Young, Bramham, Gray, & Rose, 2007). Evidence suggests that

adults with ADHD are up to eight times more likely to report a co-morbid mood, anxiety or substance misuse disorder (Kessler et al., 2006). As a result, it is perhaps unsurprising that many adults with ADHD present with clinically significant fatigue.

A modest survey including 70 adults with ADHD revealed that almost 54% had a history of fatigue (Young & Saal, 2012).

These prevalence rates far exceed those of 18% found in primary care settings (Pawlikowska et al., 1994). Reports of fatigue and day-time tiredness are more common in adults with ADHD than children or adolescents with the disorder (Fisher et al., 2014). Approximately 50% of adults who meet criteria for ADHD also meet criteria for Sluggish Cognitive Tempo disorder (SCT); a disorder characterised by symptoms of inattention, persistent daydreaming, sluggish-lethargic behaviour and hypoactivity (Barkley, 2012). It has also been suggested that adults with ADHD experience greater fatigue after cognitively demanding tasks, such as driving (Reimer, D'Ambrosio, Coughlin, Fried, & Biederman, 2007). While emerging evidence suggests that fatigue is a common associated-difficulty of ADHD in adulthood, its prevalence has not yet been adequately investigated.

Fatigue has, however, been investigated in adults with a wide range of psychiatric and neurological disorders (Chaudhuri & Behan, 2004; Fukuda et al., 1994; Targum et al., 2014).

Medically unexplained fatigue that persists for longer than six months and is present more than 50% of the time, accompanied by significant functional impairment and psychological distress, satisfies criteria for Chronic Fatigue Syndrome (CFS) (Sharpe et al., 1991). In addition to fatigue, CFS includes additional somatic symptoms (e.g. dizziness, pain) and excessive or disproportionate thoughts, feelings and behaviours. As with ADHD, a high proportion of adults with CFS also experience co-morbid anxiety and mood-related disorders (Afari & Buchwald, 2003; Wessely, Chalder, Hirsch, Wallace, & Wright, 1997).

Prevalence rates of ADHD in CFS have been estimated at almost 21%, almost six times higher than those observed in the general population (de Graaf et al., 2008; Saez-Francas et al., 2012). Studies have identified excessive energy in childhood as a potential risk factor for developing fatigue in adulthood (Harvey, Wadsworth, Wessely, & Hotopf, 2008; Harvey, Wessely, Kuh, & Hotopf, 2009). Hence, children diagnosed with ADHD hyperactive/impulsive subtype may be particularly at risk of fatigue as they grow older. Saez-Francas and colleagues (2012) found that CFS patients with co-morbid ADHD had earlier fatigue onset, more severe anxiety and depression and were at higher risk of suicide than those without ADHD co-morbidity. Rates of suicide are also higher in CFS than the general population (Roberts, Wessely, Chalder, Chang,

& Hotopf, 2016). In light of this, further research is required to better understand the trans-diagnostic processes which underlie this high risk subgroup of patients.

Trans-diagnostic approaches propose that fundamental cognitive (e.g. attention, memory, reasoning, thoughts) and behavioural (e.g. experiential avoidance) processes underlie a wide range of mental health disorders (Harvey, Watkins, Mansell & Shafran, 2004; Hayes, Wilson, Gifford, Follette & Strosahl, 1996). Viewing different disorders through a shared trans-diagnostic lens highlights common processes which maintain symptoms across disorder groups. The Research Domain Criteria (RDoC) project highlights that dysfunctions in certain behavioural functions and neural circuits (e.g. working memory, emotion regulation) are common across many disorder groups listed in the DSM or the International Classification of Diseases and Related Health Problems (ICD). RDoC advocate for an empirically-validated, dimensional approach to disorder classification (Cuthbert & Insel, 2013). Adopting a trans-diagnostic approach is one way of understanding psychiatric co-morbidity, facilitating transference of knowledge between new and established disorders and advancing developments in trans-diagnostic treatments (Mansell, Harvey, & Shafran, 2008).

Developing trans-diagnostic treatments not only facilitates the generalisation of treatment benefits across disorder groups in a more cost-effective manner, it also aids the development of more flexible treatment protocols for research purposes (McEvoy, Nathan, & Norton, 2009). Hence, evidence-based cognitive-behavioural therapy (CBT) interventions proven to be effective in reducing fatigue and psychological distress in CFS (Deale, Chalder, Marks, & Wessely, 1997; Prins et al., 2001; Quarmby, Rimes, Deale, Wessely, & Chalder, 2007; Sharpe et al., 1996; White et al., 2011) could be adapted to target fatigue in adults with ADHD. Whilst consideration of all of the trans-diagnostic processes underlying CFS and ADHD is beyond the scope of this study, a proportion of their shared clinical characteristics will be considered.

Many adults with ADHD present with significant cognitive difficulties, particularly in areas of complex attention, executive functioning, processing speed and memory (Hervey, Epstein, & Curry, 2004; Woods, Lovejoy, & Ball, 2002). Many adults with CFS also present with impairments in these areas (DeLuca, Johnson, Beldowicz, Natelson, 1995; DeLuca, Johnson, Ellis & Natelson, 1997; Tiersky, Johnson, Lange, Natelson & DeLuca, 1997; Cockshell & Mathias, 2013). Attentional processes, such as hyper-vigilance and attentional avoidance, have been hypothesised to play an active causal role in the maintenance of a variety of psychological disorders

(Mansell et al., 2008). Individuals with a particular disorder may selectively over-attend (hypervigilance) or ignore (avoid) stimuli which relate to their primary concerns. In terms of hypervigilance, studies have shown that adults with CFS perceive exertion at lower heart rates than matched controls during exercise tasks (Gibson, Carroll, Clague, & Edwards, 1993) and respond more quickly to health threat-related words, such as 'collapse' and 'hospitalisation' on the Visual Probe Task (Hou et al., 2014). Clinical reports of hyperfocus on very stimulating or rewarding tasks are also common amongst adults with ADHD. Clinical reports of 'boom and bust' behavioural patterns are also frequent in both groups, characterised by over-exertion and excessive rest in adults with CFS and extremes of behavioural impulsivity and task-avoidance in adults with ADHD.

Sleep-related difficulties have also been identified as a trans-diagnostic process common to many psychiatric disorders, contributing not only to symptom onset, but also relapse and symptom maintenance (Harvey, 2008). Sleep disorders take many forms including insomnia, hypersomnia, delayed sleep phase and nocturnal panic attacks (Harvey, 2008; Harvey, Murray, Chandler, & Soehner, 2011). Once considered an epiphenomenon, insomnia is now regarded as a fundamental factor in the aetiology and maintenance of many psychiatric disorders (Harvey, 2008). Sleep problems have long been

associated with ADHD, such that disrupted sleep was previously a diagnostic criterion until its removal from the DSM-III (DSM-III; American Psychiatric Association, 1987). Studies have shown significantly higher prevalence rates of delayed sleep phase syndrome and sleep-onset insomnia in adults with ADHD (Bijlenga et al., 2013; Fisher et al., 2014; Van Veen, Kooij, Boonstra, Gordijn, & Van Someren, 2010). Subjective and objective sleep disorders are also common in CFS (Buchwald, Pascualy, Bombardier, & Kith, 1994; Krupp, Jandorf, Coyle, & Mendelson, 1993; Morriss et al., 1993). Hence, poor sleep may exacerbate core symptoms and associated-difficulties of ADHD and CFS. Further consideration of their trans-diagnostic processes may illuminate the nature of fatigue in adult ADHD.

Whilst each disorder represents a heterogeneous group, a number of shared trans-diagnostic processes are evident in terms of fatigue, mood, cognitive and sleep-related difficulties (see figure 1). To the authors' knowledge, trans-diagnostic processes in adult ADHD and CFS have not yet been investigated in a UK outpatient setting. Primarily, this study aims to investigate the prevalence of fatigue in an adult ADHD population and the prevalence of ADHD symptomology (i.e. inattention, hyperactivity and impulsivity) in an adult CFS population. Trans-diagnostic processes underlying both clinical groups will also be investigated using self-report measures of

mood, anxiety, functional impairment, sleep, self-efficacy and participant' beliefs about the acceptability of expressing emotions. It is hypothesised that ADHD participants will report significantly higher levels of self-reported fatigue and CFS participants will report significantly greater levels of ADHD symptomology than healthy controls. ADHD and CFS groups will not differ significantly on secondary trans-diagnostic measures.

Methods

Participants

Participants were recruited from adult ADHD ($N=211$) and CFS ($N= 86$) outpatient services, where participants were attending Cognitive-Behavioural Therapy (CBT). A convenience sample of staff and students from a local university were also recruited to form a healthy control comparison group ($N = 243$).

Participants were excluded using the following criteria; verbal $IQ < 80$, non-fluent in English, presence of a primary mood, psychosis, personality or pervasive developmental disorder, current risk to self or others, active substance misuse/dependence within the last three months or history of an acquired brain injury.

ADHD participants were assessed by a consultant psychiatrist experienced in diagnosing ADHD in adulthood. DSM-IV criteria were established using a structured diagnostic interview, as these were the most up-to-date DSM criteria available at the time of the study. Collateral information was obtained from an informant to confirm childhood onset of symptoms as suggested in diagnostic guidelines (National Collaborating Centre For Mental Health, 2008). A psychiatric assessment was also conducted to exclude any other organic or psychiatric causes of ADHD symptoms. CFS participants were assessed by a physician or CBT therapist experienced in diagnosing CFS. CFS participants met CDC or Oxford criteria for CFS, established using a semi-structured diagnostic interview and a medical screening examination to exclude any other organic or psychiatric causes of fatigue as outlined in diagnostic guidelines (Sharpe, Chalder, Palmer, & Wessely, 1997; Sharpe et al., 1991).

Procedure

Questionnaires and instructions for completion were posted to participants alongside additional pre-therapy outcome measures routinely obtained prior to client's engagement with CBT. Completion of measures listed in this study is estimated to have taken participants between 20 - 30 minutes. Data was included

where participants provided written consent allowing their measures to be included in future audits and research projects within each service. Participants returned questionnaires to clinicians during therapy sessions. Reminders were provided by clinicians as necessary to support data collection. Information regarding the return rate is unfortunately unavailable; however it is estimated that most participants attending CBT completed their measures as this is part of pre-therapy standard clinical procedures.

Measures

Demographic and clinical characteristics

Information regarding the participants' demographic characteristics (age, gender, ethnicity, relationship status, education level) was obtained using a self-report measure. Participants were also asked to declare any previous episodes of fatigue which warranted GP attention as well as the presence of any current physical or mental health concerns.

Chalder Fatigue Scale (CFS; Cella & Chalder, 2010; Chalder et al., 1993)

This is an 11 item self-report measure of physical and mental fatigue. Participants rate fatigue experienced over the past month compared to their usual energy levels using a four point Likert scale, where 0 = 'less than usual' and 3 = 'much more than usual'. Scores range from zero to 33. A bimodal version can also be calculated, where scores range from 0-11, with a cut-off score of four or more indicating fatigue caseness. The CFS has excellent consistency with a Cronbach's alpha of 0.95 in the current sample.

Barkley's Current Symptom Scale (Barkley & Murphy, 2006)

This is an 18 item self-report measure denoting ADHD diagnostic criteria as outlined in the DSM-IV (American Psychiatric Association, 2000). Items assess the frequency of nine inattentive symptoms and nine hyperactive and impulsive symptoms. Participants rate the frequency of each symptom on a four point Likert scale, where 0 = never and 3 = often. Scores range from zero to 54. A score of two or more on each item is indicative of symptom presence. A cut-off point of six or more items in each domain is suggestive of clinically significant inattention or hyperactivity and impulsivity. This measure has strong reliability and validity and it has been widely used in ADHD research. In the current study, internal consistency for each subscale was excellent (inattention = 0.97, hyperactivity

and impulsivity = 0.95).

Work and Social Adjustment Scale (WASA; Mundt, Marks, Shear, & Greist, 2002)

This is a five item self-report measure of functional impairment in occupational and social settings. Participants rate each item on a Likert scale, where 0 = not impaired at all and 8 = very severely impaired. Scores range from zero to 40. A reduction of 8-points or more is suggestive of a clinically significant improvement (Zahra et al., 2014). The WASA is a reliable and valid measure which has been widely used to assess functionality in relation to a number of different disorders (Cella, Sharpe, & Chalder, 2011; Mataix-Cols et al., 2005). This scale has excellent internal consistency in the current sample with a reported Cronbach's alpha of 0.94.

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)

This measure comprises of 14 items, where seven items measure symptoms of anxiety and seven items measure symptoms of depression. Scores ranging from 0 – 7 fall within the 'Normal' range, 8 – 10 'Mild' range, 11 – 14 'Moderate'

range and 15 – 21 ‘Severe’ range. A mean Cronbach’s alpha coefficient of .83 has been reported for the anxiety subscale and .82 for the depression subscale. The HADS is an effective tool for assessing symptom severity in anxiety and somatic disorders in psychiatric and primary care settings as well as in the general population (Bjellanda, Dahlb, Haugc, & Neckelmannd, 2002). Internal consistency for both subscales was good in the current population (anxiety = 0.89, depression = 0.83).

Jenkins Sleep Evaluation Questionnaire (JSEQ; Jenkins, Stanton, Niemcryk, & Rose, 1988)

This measure comprises of four items rated on a six-point scale. Items ask how frequently during the previous four weeks the respondent has experienced 1) difficulty falling asleep, 2) difficulty staying asleep, 3) waking up several times per night and 4) waking up feeling tired and worn out after the usual amount of sleep. Response options include; 0 = not at all, 1 = 1 - 3 days, 2 = 4 - 7 days, 3 = 8 - 14 days, 4 = 15 - 21 days and 5 = 22 - 28 days. Scores range from 0 – 20, where higher scores are suggestive of a greater number of sleep problems. This scale also has acceptable internal consistency with Cronbach’s alphas ranging from of 0.63 – 0.79 in cardiac and fibromyalgia patients (Crawford, Piault, Lai, & Sarzi-Puttini, 2010) as well

0.78 in the current sample.

Generalised Self-efficacy Scale (GSE; Schwarzer & Jerusalem, 1995)

This measure is a 10 item scale measuring the respondent's capability to handle new and difficult tasks in a variety of different domains. Responses are rated on a four point scale, where 1 = not at all true, 2 = hardly true, 3 = moderately true and 4 = exactly true. Scores range from 10 – 40 with higher scores indicating greater self-efficacy. This measure has been validated cross-nationally, with Cronbach alphas range from 0.86 – 0.94 in patients with cardiovascular disease, cancer, gastrointestinal disease and healthy controls (Luszczynska, Scholz, & Schwarzer, 2005). Cronbach's alpha in the current sample was 0.92.

Beliefs about Emotions (BAE; Rimes & Chalder, 2010)

This is a 12-item self-report scale measuring beliefs about the unacceptability of experiencing and expressing emotion. Items are rated on a seven point Likert scale, where 0 = totally agree and 7 = totally disagree. Higher scores represent more maladaptive beliefs. The BAE has good internal consistency

with Cronbach's alphas of 0.91 in individuals with CFS and 0.90 in the current sample.

Statistical analysis

Statistical analysis was performed using the IBM Statistical Package for the Social Sciences version 22.0. As assumptions of normality were violated, non-parametric analyses were used. Missing items were replaced with mean scores and where more than 25% of items were missing data was excluded. However, it is noteworthy that greater than 98% of the overall sample completed over 75% of items on each measure. All significance test results are quoted as two-tailed and significance levels of .05 are reported for all tests, unless otherwise specified.

Chi-square analyses were performed to investigate differences between CFS, ADHD and HC groups on demographic and clinical characteristics, with the exception of age which was investigated using a Kruskal Wallis test.

Between-group differences on measures of fatigue, ADHD symptomology, mood, anxiety, functional impairment, sleep, self-efficacy and beliefs about emotions were investigated using multiple Kruskal Wallis tests. A further Kruskal Wallis test was performed on the HADS anxiety subscale with items A1, A4 and A6 removed to control for physical restlessness as a

possible confounding variable with ADHD symptomology.

Adjusted significance values were interpreted to account for multiple comparisons across the three participant groups. The percentage of participants in each group meeting criteria for caseness in fatigue, depression, anxiety, inattention and hyperactivity or impulsivity were compared using chi square analyses.

Ethical approval

Ethical approval was received from the relevant local committee. The nature and purpose of the study was fully explained to participants prior to obtaining informed consent.

Results

Demographic characteristics

Results illustrate that CFS ($N = 86$), ADHD ($N = 204$) and HC ($N = 243$) groups differed significantly across demographic and clinical characteristics. Medians (Mdn), interquartile ranges (IQR) and test statistics for Kruskal Wallis and chi square analyses are reported in table 1. Adjusted significance values

are reported for Kruskal Wallis post-hoc analyses to account for multiple comparisons.

A significant difference in age was found across CFS, ADHD and HC groups, however post-hoc analyses failed to detect any significant pairwise comparisons. Significant gender differences were also observed across participant groups, with 70% of the ADHD group comprising of males compared with only 27% of CFS and HC groups respectively. The ADHD group were more ethnically diverse, with 23% identifying as other than white British, compared with 19% of CFS and 8% of HC groups. ADHD and CFS groups were similar in terms of education and relationship status, with approximately half of each group educated to University level and a third identifying as married or living together. This contrasted with the HC group, of whom a greater proportion was educated to University level (88%) and married or living together (52%).

Clinical characteristics

Forty-five percent of ADHD participants declared that they had previously experienced an episode of fatigue that warranted GP attention, compared with only 17% of HC participants. Recent reports of physical and mental health concerns were more common in patient groups than HC. CFS participants (34%)

were more likely to present with a current physical health concern than ADHD participants (23%). Approximately half of both patient groups reported current mental health problems.

Between-groups comparisons for fatigue

A significant range of fatigue scores were observed within an across participants groups (see figure 1). Kruskal-Wallis tests demonstrated a significant between-groups difference for fatigue. Post-hoc comparisons revealed that the ADHD group reported significantly lower levels of fatigue than the CFS group. However the ADHD group did report significantly higher levels of fatigue than controls. This pattern was also observed for both the physical and mental fatigue subscales (see table 2).

Results of a chi square analysis detected a significant difference between participant groups regarding the percentage of participants meeting the Chalder et al. (2013) criteria for fatigue caseness. The ADHD group (62%) had fewer participants meeting caseness for fatigue than the CFS group (86%), however the ADHD group had considerably more participants meeting criteria than the HC group (26%).

Between-groups comparisons for ADHD symptomatology

Kruskal-Wallis tests demonstrated a significant between-groups difference for ADHD symptomatology. Perhaps unsurprisingly, post-hoc analyses revealed significantly higher Barkley scores in the ADHD group than in either comparison group. However, interestingly, the CFS group also obtained significantly higher ADHD scores than controls.

A chi-square test revealed a significant difference between ADHD, CFS and HC groups in terms of the percentage participants in each group meeting criteria for symptom presence (i.e. positive responses to 6 out of 9 criteria in each domain). Seventy-three percent of ADHD participants met criteria for inattention symptom presence, compared with 12% of CFS and 0% of controls. A lesser proportion of ADHD participants met criteria for hyperactivity and impulsivity symptom presence (44%) compared with only 6% of CFS and 0% of controls.

Between-groups comparisons for trans-diagnostic measures

A further series of Kruskal-Wallis tests detected significant between-group differences across all secondary clinical measures (see table 4).

There were no significant post-hoc differences between the ADHD and CFS groups on the HADS depression scale;

however both patient groups reported significantly higher levels of depression than controls. A similar proportion of patients in the ADHD and CFS groups reported mild symptoms of depression or higher (46% and 48% respectively). These rates were considerably higher than those observed in the control group (8.5%).

Post-hoc analyses revealed significantly higher HADS anxiety scores in the ADHD group than the CFS group, with both patient groups reporting significantly higher anxiety than the HC group. Seventy-nine percent of ADHD participants reported mild symptoms of anxiety or higher, compared with 56% and 29% of CFS and controls.

Group HADS anxiety scores were again compared with confounding items relating to physical restlessness as a confounding ADHD symptomology variable (e.g. item A1 ‘I feel tense of “wound up”’) omitted. Post-hoc analyses failed to detect a significant difference between ADHD and CFS groups; however both clinical groups continued to report significantly higher scores than controls.

There were no significant post-hoc differences between the ADHD and CFS groups on measures of functional impairment and self-efficacy, with both patients groups significantly more impaired than controls.

Post-hoc analyses revealed a significantly higher number of sleep-related difficulties in the CFS group than the ADHD group, with both patient groups reporting significantly more sleep-related difficulties than controls.

The ADHD group reported significantly higher scores than CFS group on the beliefs about emotions measure; however no significant differences were detected between the CFS group and controls.

Discussion

This study primarily aimed to investigate the prevalence of fatigue in an adult ADHD outpatient population. Whilst many studies have focused on sleep-related difficulties in adult ADHD (Bijlenga et al., 2013; Fisher et al., 2014; Philipsen, Hornyak, & Riemann, 2006; Van Veen, Kooij, Boonstra, Gordijn, & Van Someren, 2010), there has been a dearth of research investigating fatigue. Results suggest that fatigue is significantly greater in adults with ADHD than healthy controls. This trend was observed for both physical and mental fatigue, with 63% of ADHD participants meeting the Chalder et al. (2013) criteria for fatigue caseness. Whilst the chronicity of fatigue was not formally assessed in this study, 45% of

participants in the ADHD group reported having previously experienced an episode of fatigue that warranted GP attention. Fatigue prevalence rates reported here are comparable with those from a brief survey carried out with adults with ADHD (Young & Saal, 2012) and vastly exceed those of fatigue reported in primary care settings (Pawlikowska et al., 1994; Wessely, Chalder, Hirsch, Wallace, & Wright, 1997). Hence, initial results suggest that fatigue is a common yet under-recognised clinical feature of ADHD in adulthood.

In comparison with the CFS group, the ADHD group were significantly less fatigued. Although fatigue is the primary concern of those with CFS and regarded as an epiphenomenon in ADHD, sleep problems were significantly higher in the CFS group and as such this finding may have been a confounding variable as links between sleep-related difficulties and day-time fatigue are well-recognised in this group (Buchwald, Pascualy, Bombardier, & Kith, 1994; Krupp, Jandorf, Coyle, & Mendelson, 1993; Morriss et al., 1993). Hence, discrepancies noted between CFS and ADHD groups in this study cannot be assumed to reflect differences in fatigue alone.

The secondary aim of this study was to investigate the prevalence of ADHD symptomology (i.e. inattention, hyperactivity and impulsivity) in adults with CFS. Almost 12% of the CFS group reported symptoms of inattention reaching

clinical significance and 6% reported symptoms of hyperactivity and impulsivity reaching clinical significance. These scores are considerably lower than those detected in the ADHD group (73% and 44% respectively); however they vastly exceed those found in the control group (less than 1%). Although other studies have observed prevalence rates of up to 21% in the CFS population (de Graaf et al., 2008; Saez-Francas et al., 2012), self-report measures of ADHD symptomology cannot be assumed diagnostic when considered in isolation. Self-report measures form only one part of a comprehensive adult ADHD assessment according to diagnostic guidelines. Nonetheless, self-report scores reported here suggest that attentional difficulties are more prevalent in the CFS group than the control group. These results are in-keeping with reports of attention and information processing speed difficulties noted in the wider CFS literature (DeLuca, Johnson, Beldowicz, Natelson, 1995; DeLuca, Johnson, Ellis & Natelson, 1997; Tiersky, Johnson, Lange, Natelson & DeLuca, 1997; Cockshell & Mathias, 2013).

Lastly, this study aimed to investigate trans-diagnostic processes underlying ADHD and CFS. Results suggest that both clinical groups performed homogenously across a range of secondary clinical measures, including mood, functional impairment and self-efficacy. Approximately half of both clinical groups met caseness for mild depression. Initial results

suggest that ADHD participants were considerably more anxious than CFS participants; however when items relating to physical restlessness (e.g. I feel tense or "wound up") were removed due to their confounding relationship with ADHD symptomology, no significant differences were found between the two groups. These results are consistent with rates of psychiatric co-morbidity found in both groups (Afari & Buchwald, 2003; Kessler et al., 2006; Wessely, Chalder, Hirsch, Wallace, & Wright, 1997) and support the hypothesis that there are shared trans-diagnostic processes common across disorder groups (Mansell, Harvey, & Shafran, 2008), shedding further light on why almost half of all psychological disorders are found to be co-morbid (Cuthbert & Insel, 2013; Kessler, Chiu, Demler, & Walters, 2005).

Benefits of adopting a trans-diagnostic approach to mental health difficulties have been well documented, not least those relating to the generalisation of knowledge from established models to new psychological phenomena (Harvey, Watkins, Mansell, & Shafran, 2004; Mansell et al., 2008). Results from this study suggest that screening for fatigue in adult ADHD services would be beneficial, such that fatigue management information already available for other conditions (e.g. chronic fatigue) could be provided to clients at an early stage before symptoms become functionally impairing. Furthermore, where fatigue is deemed to be more severe, established Cognitive-

Behavioural Therapy (CBT) treatment manuals for fatigue (Burgess & Chalder, 2005; Deale, Chalder, Marks, & Wessely, 1997; Quarmby, Rimes, Deale, Wessely, & Chalder, 2007) could be adapted for use with adults with ADHD. These could help address such maintaining factors as ‘boom and bust’ behaviours in everyday tasks, negative self-beliefs and unhelpful emotional regulation strategies, such as experiential avoidance. An individualised, formulation-based CBT approach to treating associated difficulties of ADHD in adulthood (Dittner, Rimes, Russell, & Chalder, 2014) would make it possible to target such maintaining difficulties directly.

Likewise, CFS patients would benefit from psychoeducation regarding the nature of cognition and factors which affect memory, attention and concentration, in addition to specific skills training to improve inattention, hyperactivity and impulsivity (e.g. help with planning and organization). CFS patients may also benefit from therapeutic interventions which target negative self-beliefs that arise from difficulties with attention and concentration, as these beliefs may impact upon mood, self-efficacy and functional capabilities.

A number of limitations must also be noted with regards to the findings of this study. In terms of the sample recruited, ADHD and CFS participants were attending national specialist services and therefore results may not be representative of local

services. Equally, groups were not matched on socio-demographic variables (e.g. gender, age and ethnicity). However, clinical groups did not differ significantly in terms of age, educational background and relationship status. Indeed 88% of healthy controls were university educated and hence their results may not reflect the distribution of cognitive and mood-related difficulties found in the general population. As questionnaires were completed by participants independently, it is possible that questionnaires were susceptible to fatigue effects and counterbalancing was not implemented. It is also possible that less impaired participants were more likely to complete and return questionnaires and hence results presented in this study may not be completely representative. However, it is noteworthy that 86% of CFS participants in this study met the Chalder et al. (2013) criteria for fatigue and 100% reported fatigue as a significant problem at the time of assessment. Hence CFS participants were assumed to suffer from significant and debilitating fatigue.

In conclusion, there appear to be a number of trans-diagnostic processes common to both ADHD and CFS, as indicated by the results of this study. Clinical features of fatigue in addition to attentional, sleep and mood-related difficulties appear to be present to varying degrees in both clinical populations.

Research suggests that patients meeting criteria for both disorders are at high risk of suicidality and mortality (Roberts,

Wessely, Chalder, Chang, & Hotopf, 2016; Saez-Francas et al., 2012), hence further evaluation into fatigue in adult ADHD is required to meet the needs of this complex client group.

Developments towards trans-diagnostic treatments also pose exponential benefits to public health and clinical service providers, in terms of providing cost-efficient interventions to meet the needs of a range of service-users across mental health services, whilst reducing training requirements and treatment waiting times (McEvoy, Nathan, & Norton, 2009).

References

Afari, N., & Buchwald, D. (2003). Chronic Fatigue Syndrome: A Review. *American Journal of Psychiatry*, 160, 221 - 236.

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (Vol. 3rd). Washington, DC.

American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders* (Vol. 4th). Washington, DC.

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (Vol. 5th). Washington, DC.

Barkley, R. (2014). *Attention-Deficit Hyperactivity Disorder A Handbook for Diagnosis and Treatment* (Vol. 4th). New York: The Guilford Press.

Barkley, R. (2012). Distinguishing sluggish cognitive tempo from attention-deficit/hyperactivity disorder in adults. *Journal of Abnormal Psychology*, 121(4), 978 - 999.

Barkley, R. A., & Murphy, K. R. (2006). *Attention-Deficit Hyperactivity Disorder A Clinical Workbook* (Vol. 3rd). New York: The Guilford Press.

Biederman, J., Petty, C., Fried, R., Fontanella, J., Doyle, A. E., Seidman, L. J., & Faraone, S. V. (2006). Impact of Psychometrically Defined Deficits of Executive Functioning in Adults With Attention Deficit Hyperactivity Disorder. *American Journal of Psychiatry*, 163, 1730 - 1738.

Bijlenga, D., van der Heijden, K. B., Breuk, M., van Someren, E. J., Lie, M. E., Boonstra, A. M., . . . Kooij, J. J. (2013). Associations between sleep characteristics, seasonal depressive symptoms, lifestyle, and ADHD symptoms in adults. *Journal of Attention Disorders*, 17(3), 261-275.

Birchwood, J., & Daley, D. (2012). Brief report: The impact of attention deficit hyperactivity disorder (ADHD) symptoms on academic performance in an adolescent community sample. *Journal of Adolescence*, 35(1), 225-231.

Bjellanda, I., Dahlb, A. A., Hauge, T. T., & Neckelmannnd, D. (2002). The validity of the Hospital Anxiety and Depression Scale: An updated literature review. *Journal of Psychosomatic Research*, 52, 69 - 77.

Buchwald, D., Pascualy, R., Bombardier, C., & Kith, P. (1994). Sleep disorders in Patients with Chronic Fatigue. *Clinical Infectious Diseases*, 18, 68 - 72.

Burgess, M., & Chalder, T. (2005). *Overcoming Chronic Fatigue*. London: Constable Robinson.

Cella, M., & Chalder, T. (2010). Measuring fatigue in clinical and community settings. *Journal of Psychosomatic Research*, 69(1), 17-22.

Cella, M., Sharpe, M., & Chalder, T. (2011). Measuring disability in patients with chronic fatigue syndrome: reliability and validity of the Work and Social Adjustment Scale. *Journal of Psychosomatic Research*, 71(3), 124-128.

Chalder, T., Berelowitz, G., Pawlikowska, T., Watts, L., Wessely, S., Wright, D., & Wallace, E. P. (1993). Development of a fatigue scale. *Journal of Psychosomatic Research*, 37(2), 147 - 153.

Chaudhuri, A., & Behan, P. O. (2004). Fatigue in neurological disorders. *The Lancet*, 363(9413), 978-988.

Cockshell, S. J., & Mathias, J. L. (2013). Cognitive Deficits in Chronic Fatigue Syndrome and Their Relationship to Psychological Status, Symptomatology, and Everyday Functioning. *Neuropsychology*, 27(2), 230 –242.

Crawford, B. K., Piau, E. C., Lai, C., & Sarzi-Putini, P. (2010). Assessing sleep in fibromyalgia: investigation of an alternative scoring method for the Jenkins Sleep Scale based on data from randomised controlled studies. *Clinical and Experimental Rheumatology*, 28(63), 100 - 109.

Cuthbert, B. N., & Insel, T. R. (2013). Towards the future of psychiatric diagnosis the seven pillars of RDoC. *BMC Medicine*, 11(126), 1 - 8.

de Graaf, R., Kessler, R. C., Fayyad, J., ten Have, M., Alonso, J., Angermeyer, M., . . . Posada-Villa, J. (2008). The prevalence and effects of adult attention-deficit/hyperactivity disorder (ADHD) on the performance of workers: results from the WHO World Mental Health Survey Initiative. *Occupational and Environmental Medicine*, 65(12), 835-842.

Deale, A., Chalder, T., Marks, I., & Wessely, S. (1997). Cognitive Behavioural Therapy for Chronic Fatigue Syndrome: A Randomized Controlled Trial. *American Journal of Psychiatry*, 154, 408 - 414.

DeLuca, J., Johnson, S. K., Beldowicz, D., & Natelson, B. H. (1995). Neuropsychological impairments in chronic fatigue syndrome, multiple sclerosis and depression. *Journal of Neurology, Neurosurgery and Psychiatry*, 58, 38 - 43.

DeLuca, J., Johnson, S. K., Ellis, S. P., & Natelson, B. H. (1997). Cognitive functioning is impaired in patients with chronic fatigue syndrome devoid of psychiatric disease. *Journal of Neurology, Neurosurgery and Psychiatry*, 62, 151 - 155.

Dittner, A. J., Rimes, K. A., Russell, A. J., & Chalder, T.

(2014). Protocol for a proof of concept randomized controlled trial of cognitive-behavioural therapy for adult ADHD as a supplement to treatment as usual, compared with treatment as usual alone. *BMC Psychiatry*, 14(248), 1 - 11.

Fisher, B. C., Garges, D. M., Yoon, S. Y., Maguire, K., Zipay, D., Gambino, M., & Shapiro, C. M. (2014). Sex differences and the interaction of age and sleep issues in neuropsychological testing performance across the lifespan in an ADD/ADHD sample from the years 1989 to 2009. *Psychological Reports*, 114(2), 404-438.

Fukuda, K., Straus, S. E., Hickie, I., Sharpe, M. C., Dobbins, J. G., & Komaroff, A. (1994). The CFS a comprehensive approach to its definition and study. *Annals of Internal Medicine*, 121, 953 - 995.

Gibson, H., Carroll, N., Clague, J. E., & Edwards, R. H. T. (1993). Exercise performance and fatigability in patients with chronic fatigue syndrome. *Journal of Neurology, Neurosurgery and Psychiatry*, 56, 993-998.

Halmøy, A., Fasmer, O. B., Gillberg, C., & Haavik, J. (2009). Occupational Outcome in Adult ADHD: Impact of Symptom Profile, Comorbid Psychiatric Problems, and Treatment A Cross-Sectional Study of 414 Clinically Diagnosed Adult ADHD Patients. *Journal of Attention Disorders*, 13(2), 175 -

Harvey, A., Watkins, E., Mansell, W., & Shafran, R. (2004).

Cognitive Behavioural Processes across Psychological Disorders. Oxford: Oxford University Press.

Harvey, A. G. (2008). Insomnia, Psychiatric Disorders and the

Transdiagnostic Perspective. *Current Directions in Psychological Science*, 7(5), 209 - 303.

Harvey, A. G., Murray, G., Chandler, R. A., & Soehner, A.

(2011). Sleep disturbance as transdiagnostic: consideration of neurobiological mechanisms. *Clinical Psychology Review*, 31(2), 225-235.

Harvey, S. B., Wadsworth, M., Wessely, S., & Hotopf, M.

(2008). The relationship between prior psychiatric disorder and chronic fatigue: evidence from a national birth cohort study. *Psychological Medicine*, 38(7), 933-940.

Harvey, S. B., Wessely, S., Kuh, D., & Hotopf, M. (2009). The

relationship between fatigue and psychiatric disorders: evidence for the concept of neurasthenia. *Journal of Psychosomatic Research*, 66(5), 445-454.

Hayes, S. C., Wilson, K. G., Gifford, E. V., Follette, V. M., &

Strosahl, K. (1996). Experiential avoidance and behavioral disorders: A functional dimensional approach to diagnosis and

treatment. *Journal of Consulting and Clinical Psychology*, 64(6), 1152 - 1168.

Hervey, A. S., Epstein, J. N., & Curry, J. F. (2004).

Neuropsychology of adults with attention-deficit/hyperactivity disorder: a meta-analytic review. *Neuropsychology*, 18(3), 485-503.

Hou, R., Moss-Morris, R., Risdale, A., Lynch, J., Jeevaratnam, P., Bradley, B. P., & Mogg, K. (2014). Attention processes in chronic fatigue syndrome: attentional bias for health-related threat and the role of attentional control. *Behaviour Research and Therapy*, 52, 9-16.

Jenkins, C. D., Stanton, B., Niemcryk, S., & Rose, R. M. (1988). A Scale For The Estimation of Sleep Problems in Clinical Research. *Journal of Clinical Epidemiology*, 41(4), 313 - 321.

Kessler, R. C., Adler, L., Barkley, R., Biederman, J., Conners, C. K., Demler, O., . . . Zaslavsky, A. M. (2006). The Prevalence and Correlates of Adult ADHD in the United States: Results From the National Comorbidity Survey Replication. *American Journal of Psychiatry*, 163, 716 - 723.

Kessler, R. C., Chiu, W. T., Demler, O., & Walters, E. E. (2005). Prevalence, Severity, and Comorbidity of Twelve-month DSM-IV Disorders in the National Comorbidity Survey

Replication (NCSR). *Archives of General Psychiatry*, 62(6), 617 - 627.

Knouse, L. E., & Safren, S. A. (2010). Current Status of Cognitive Behavioral Therapy for Adult Attention-Deficit Hyperactivity Disorder. *Psychiatry Clinics of North America*, 33(3), 497 - 509.

Krupp, L. B., Jandorf, L., Coyle, P. K., & Mendelson, W. B. (1993). Sleep disturbance in Chronic Fatigue Syndrome. *Journal of Psychosomatic Research*, 37(4), 325 - 331.

Luszczynska, A., Scholz, U., & Schwarzer, R. (2005). The General Self-Efficacy Scale: Multicultural Validation Studies. *The Journal of Psychology*, 139(5), 439 - 457.

Mansell, W., Harvey, A. G., & Shafran, R. (2008). Cognitive Behavioral Processes Across Psychological Disorders: A Review of the Utility and Validity of the Transdiagnostic Approach. *International Journal of Cognitive Therapy*, 1(3), 181–191.

Mataix-Colsa, D., Cowleya, A. J., Hankinsa, M., Schneiderb, A., Bachofenb, M., Kenwrightb, M., . . . Marksa, I. M. (2005). Reliability and validity of the Work and Social Adjustment Scale in phobic disorders. *Comprehensive Psychiatry*, 46, 223–228.

McEvoy, P. M., Nathan, P., & Norton, P. J. (2009). Efficacy of Transdiagnostic Treatments: A Review of Published Outcome Studies and Future Research Directions. *Journal of Cognitive Psychotherapy*, 23(1), 20-33.

Morriss, R., Sharpe, M., Sharpley, A. L., Cowen, P. J., Hawton, K., & Morris, J. (1993). Abnormalities of sleep in patients with the chronic fatigue syndrome. *British Medical Journal*, 306, 1161 - 1164.

Mundt, J. C., Marks, I. M., Shear, M. K., & Greist, J. H. (2002). The Work and Social Adjustment Scale: a simple measure of impairment in functioning. *British Journal of Psychiatry*, 180, 461 - 464.

National Collaborating Centre For Mental Health. (2008). *Attention deficit hyperactivity disorder: diagnosis and management of ADHD in children, young people and adults*. In NICE (Ed.). London.

Newark, P. E., Elsasser, M., & Stieglitz, R. D. (2016). Self-Esteem, Self-Efficacy, and Resources in Adults With ADHD. *Journal of Attention Disorders*, 20(3), 279-290.

Pawlikowska, T., Chalder, T., Hirsch, S. R., Wallace, P., Wright, D. J. M., & Wessely, S. C. (1994). Population based study of fatigue and psychological distress. *British Medical Journal*, 308, 763 - 766.

Philipsen, A., Hornyak, M., & Riemann, D. (2006). Sleep and sleep disorders in adults with Attention Deficit Hyperactivity Disorder. *Sleep Medicine Review*, 10, 399 - 405.

Prins, J. B., Bleijenberg, G., Bazelmans, E., Elving, L. D., de Boo, T. M., Severens, J. L., . . . van der Meer, J. W. M. (2001). Cognitive behaviour therapy for chronic fatigue syndrome: a multicentre randomised controlled trial. *The Lancet*, 357(9259), 841-847.

Quarmby, L., Rimes, K. A., Deale, A., Wessely, S., & Chalder, T. (2007). Cognitive-behaviour therapy for chronic fatigue syndrome: comparison of outcomes within and outside the confines of a randomised controlled trial. *Behaviour Research and Therapy*, 45(6), 1085-1094.

Ramirez, C. A., Rosén, L. A., Deffenbacher, J. L., Hurst, H., Nicoletta, C., Rosencranz, T., & Smith, K. (1997). Anger and anger expression in adults with high ADHD symptoms. *Journal of Attention Disorders*, 2(2), 115 - 128.

Reimer, B., D'Ambrosio, L. A., Coughlin, J. F., Fried, R., & Biederman, J. (2007). Task-induced fatigue and collisions in adult drivers with attention deficit hyperactivity disorder. *Traffic Injury Prevention*, 8(3), 290-299.

Rimes, K. A., & Chalder, T. (2010). The Beliefs about Emotions Scale: validity, reliability and sensitivity to change.

Journal of Psychosomatic Research, 68(3), 285-292.

Roberts, E., Wessely, S., Chalder, T., Chang, C., & Hotopf, M. (2016). Mortality of people with chronic fatigue syndrome: a retrospective cohort study in England and Wales from the South London and Maudsley NHS Foundation Trust Biomedical Research Centre (SLaM BRC) Clinical Record Interactive Search (CRIS) Register. *The Lancet*, 387(10028), 1638-1643.

Sacchetti, G. M., & Lefler, E. K. (2014). ADHD Symptomology and Social Functioning in College Students. *Journal of Attention Disorders*, XX, 1 - 11. DOI: 10.1177/1087054714557355.

Saez-Francas, N., Alegre, J., Calvo, N., Antonio Ramos-Quiroga, J., Ruiz, E., Hernandez-Vara, J., & Casas, M. (2012). Attention-deficit hyperactivity disorder in chronic fatigue syndrome patients. *Psychiatry Research*, 200(2-3), 748-753. doi: 10.1016/j.psychres.2012.04.041

Schwarzer, R., & Jerusalem, M. (1995). Generalized Self-Efficacy scale. . In J. Weinman, S. Wright & M. Johnston (Eds.), *Measures in health psychology: A user's portfolio. Causal and control beliefs*. Windsor, UK: Nfer-Nelson.

Sharpe, M., Chalder, T., Palmer, I., & Wessely, S. (1997). Chronic Fatigue Syndrome: A Practical Guide to Assessment and Management. *General Hospital Psychiatry*, 19, 185 - 199.

Sharpe, M., Hawton, K., Simkin, S., Surawy, C., Hackmann, A., Klimes, I., . . . Seagroatt, V. (1996). Cognitive behaviour therapy for the chronic fatigue syndrome: a randomised controlled trial. *British Medical Journal*, 312(7022), 22-26.

Sharpe, M. C., Banatvala, J. E., Borysiewicz, L. K., Clare, A. W., David, A., Edwards, R. H. T., . . . White, P. D. (1991). A report - chronic fatigue syndrome: guidelines for research. *Journal of the Royal Society of Medicine*, 84, 118 -121.

Shaw-Zirt, B., Popali-Lehane, L., Chaplin, W., & Bergman, A. (2005). Adjustment, Social Skills, and Self-Esteem in College Students With Symptoms of ADHD. *Journal of Attention Disorders*, 8(3), 109 - 120.

Tabassam, W., & Grainger, J. (2002). Self concept, attributional style and self-efficacy beliefs of students with learning disabilities with and without attention deficit hyperactivity disorder. *Learning Disability Quarterly*, 25, 141 - 151.

Targum, S. D., Fava, M., Alphas, L. D., Starr, H. L., Wessel, T. C., & Hilt, D. C. (2014). Fatigue across the CNS spectrum: a clinical review. *Fatigue: Biomedicine, Health & Behavior*, 2(4), 231-246.

Tiersky, L. A., Johnson, S. K., Lange, G., Natelson, B. H., & DeLuca, J. (1997). Neuropsychology of chronic fatigue syndrome: a critical review. *Journal of Clinical and*

Experimental Neuropsychology, 19(4), 560-586.

Van Veen, M. M., Kooij, J. J., Boonstra, A. M., Gordijn, M. C., & Van Someren, E. J. (2010). Delayed circadian rhythm in adults with attention-deficit/hyperactivity disorder and chronic sleep-onset insomnia. *Biological Psychiatry*, 67(11), 1091-1096.

Wessely, S., Chalder, T., Hirsch, S., Wallace, P., & Wright, D. (1997). The prevalence and morbidity of chronic fatigue and CFS a prospective primary care study. *American Journal of Public Health*, 87(9), 1449 - 1455.

White, P. D., Goldsmith, K. A., Johnson, A. L., Potts, L., Walwyn, R., DeCesare, J. C., . . . Sharpe, M. (2011). Comparison of adaptive pacing therapy, cognitive behaviour therapy, graded exercise therapy, and specialist medical care for chronic fatigue syndrome (PACE): a randomised trial. *The Lancet*, 377(9768), 823-836.

Woods, S. P., Lovejoy, D. W., & Ball, J. D. (2002). Neuropsychological Characteristics of Adults with ADHD: A Comprehensive Review of Initial Studies. *The Clinical Neuropsychologist*, 16(1), 12 - 34.

Young, J. L., & Saal, J. (2012). *A Survey of Outpatient Adults with Attention Deficit/ Hyperactivity Disorder*. Paper presented at the 5th Annual Alumni Association Conference and

Departmental Research Day, Detroit, MI.

Young, S., Bramham, J., Gray, K., & Rose, E. (2007).

Experience of Receiving a Diagnosis and Treatment of ADHD
in Adulthood: A Qualitative Study of Clinically Referred
Patients Using Interpretative Phenomenological Analysis.

Journal of Attention Disorders, XX, 1 - 11. doi: DOI:

10.1177/1087054707305172.

Zigmond, A. S., & Snaith, R. P. (1983). The Hospital Anxiety
and Depression Scale. *Acta Psychiatrica Scandinavica*, 67, 361
- 370.

Figures and tables

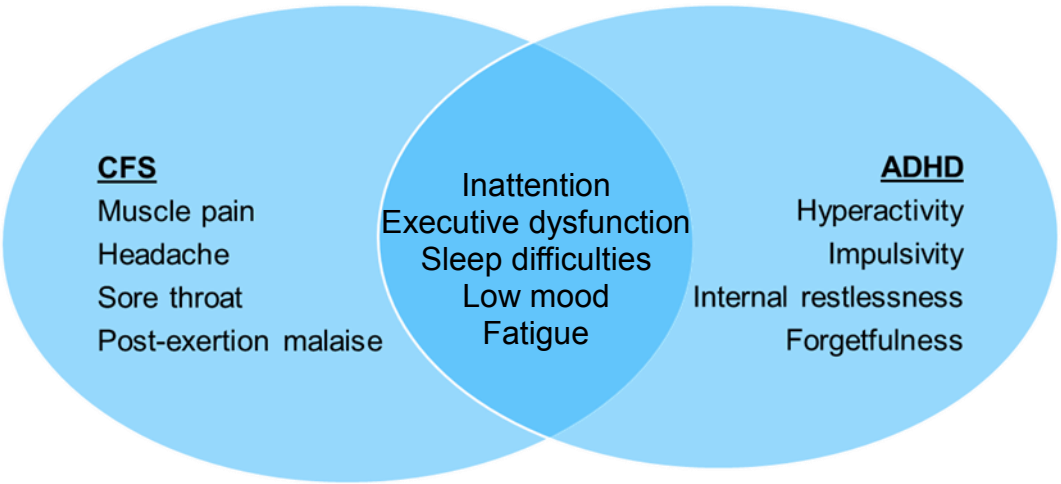


Figure 1. Trans-diagnostic processes in adults with Attention Deficit Hyperactivity Disorder (ADHD) and Chronic Fatigue Syndrome (CFS).

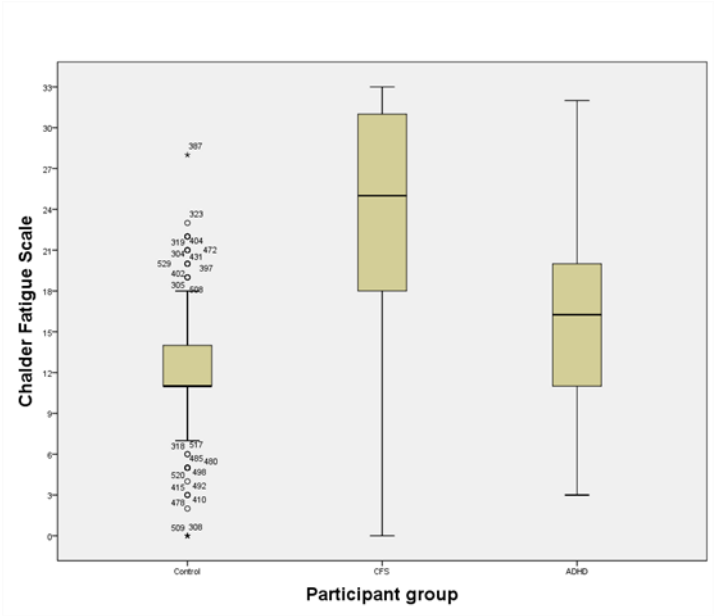


Figure 2. Total fatigue scores in participant groups

Table .1 Between-group comparisons for participant characteristics

Characteristic	HC (N =243)	CFS (N = 86)	ADHD (N = 211)	Test statistic (df)	p
	<i>Mdn</i> (<i>IQR</i>)	<i>Mdn</i> (<i>IQR</i>)	<i>Mdn</i> (<i>IQR</i>)		
Age	31 (14)	36 (19)	36 (14)	6.8 (2, 533)	0.033
Gender	N (%)	N (%)	N (%)		
Male	66 (27)	23 (27)	147 (70)		
Female	177 (73)	63 (73)	64 (30)	94.9 (2, 540)	0.0001
Ethnicity					
White	224 (92)	68 (81)	143 (77)		
Other	19 (8)	16 (19)	43 (23)	20.3 (2, 513)	0.0001
Education					
None/Secondary	14 (5.7)	16 (19)	39 (26)		
Polytechnic	16 (6.6)	20 (24)	35 (23)		
University	214 (87.7)	48 (57)	76 (51)	71.7 (4, 478)	0.0001
Relationship status					
Single	104 (43)	50 (58)	81 (53)		
Married/Living together	127 (52)	26 (30)	57 (37)		
Other	13 (5)	10 (12)	15 (10)	17.2 (4, 483)	0.002
Previous fatigue					
Yes	42 (17)	86 (100)	34 (45)		
No	202 (83)	0 (0)	41 (55)	182.7 (2, 405)	0.0001
Current physical illness					
Yes	37 (15)	29 (34)	17 (23)		
No	207 (85)	56 (66)	58 (77)	14.1 (2, 404)	0.001
Current mental health					
Yes	19 (8)	37 (44)	41 (55)		
No	223 (92)	47 (56)	33 (45)	92.45 (2, 400)	0.0001

Abbreviations: HC: healthy controls; CFS: Chronic Fatigue Syndrome; ADHD: Attention Deficit Hyperactivity Disorder; N : Number; df : Degrees of freedom; p : Probability value; Mdn: Median; IQR : Interquartile range.

Table 2. Between-groups comparisons for fatigue

	HC	CFS	ADHD	Test statistic		Post-hoc
Subscales	(<i>N</i> = 223)	(<i>N</i> = 86)	(<i>N</i> = 76)	(<i>df</i>)	<i>p</i>	comparisons
	<i>Mdn</i>	<i>Mdn</i>	<i>Mdn</i>			
<i>CFS Likert Scale</i>	(<i>IQR</i>)	(<i>IQR</i>)	(<i>IQR</i>)			
Total Fatigue	11 (3)	25 (13)	16.25 (9)	131.42 (2, 385)	0.0001	CFS > ADHD > HC
Physical Fatigue	7 (3)	17 (8)	9 (5)	120.6 (2, 385)	0.0001	CFS > ADHD > HC
Mental Fatigue	4 (1)	8 (5)	6.5 (5)	127.92 (2, 385)	0.0001	CFS > ADHD > HC
<i>CFS Bimodal Scale</i>	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>			
Fatigue	58/223	74/86	47/76			
Caseness	(26%)	(86%)	(62%)	98.9 (2, 385)	0.0001	

Abbreviations: HC: healthy controls; CFS: Chronic Fatigue Syndrome; ADHD: Attention Deficit Hyperactivity Disorder; N: Number; df:

Degrees of freedom; p: Probability value; Mdn: Median; IQR: Interquartile range.

Table 3. Between-groups comparisons for ADHD symptomatology

	HC	CFS	ADHD	Test statistic		Post-hoc
Subscale	(N = 223)	(N = 86)	(N = 208)	(df)	p	comparisons
	<i>Mdn</i>	<i>Mdn</i>	<i>Mdn</i>			
	(IQR)	(IQR)	(IQR)			
ADHD symptomology	0 (2)	15 (10)	33 (16)	418.87 (2, 520)	0.0001	ADHD > CFS > HC
Caseness	N (%)	N (%)	N (%)			
Inattention	0 (0)	10 (11.8)	104 (73.2)	25.08 (2, 454)	0.0001	
Hyperactivity/Impulsivity	0 (0)	5 (5.9)	63 (43.8)	139.20 (2, 455)	0.0001	

Abbreviations: HC: healthy controls; CFS: Chronic Fatigue Syndrome; ADHD: Attention Deficit Hyperactivity Disorder; N: Number; df:

Degrees of freedom; p: Probability value; Mdn: Median; IQR: Interquartile range.

Table 4. Between-groups comparisons on trans-diagnostic measures

	HC	CFS	ADHD	Test statistic		Post-hoc
Measures	(<i>N</i> = 223)	(<i>N</i> = 86)	(<i>N</i> = 208)	χ^2 (<i>df</i>)	<i>p</i>	comparisons
	<i>Mdn</i>	<i>Mdn</i>	<i>Mdn</i>			
	(<i>IQR</i>)	(<i>IQR</i>)	(<i>IQR</i>)			
Functional impairment	0 (2)	28 (18)	22 (18)	318.43 (2, 514)	0.0001	ADHD = CFS > HC
Depression	2 (3)	7 (7)	7 (7)	160.47 (2, 505)	0.0001	ADHD = CFS > HC
Anxiety	5 (5)	8.5 (7)	12 (6)	120.29 (2, 506)	0.0001	ADHD > CFS > HC
Anxiety (physical restlessness items removed)	6 (4)	5 (5)	3 (4)	71.35 (2, 508)	0.0001	ADHD = CFS > HC
Sleep	5 (5)	11.5 (6)	9 (8)	105.32 (2, 381)	0.0001	CFS > ADHD > HC
Self-efficacy	33 (7)	29 (4)	28 (10)	79.39 (2, 367)	0.0001	ADHD = CFS > HC
Beliefs about emotions	34 (19)	38 (25)	40 (19)	31.68 (2, 475)	0.0001	ADHD > CFS = HC

Caseness	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>		
Depression	18/212 (8.5)	41/86 (48)	96/207 (46)	84.72 (2, 505)	0.0001
Anxiety	61/212 (29)	48/86 (56)	164/208 (79)	106.1 (2, 506)	0.0001

Abbreviations: HC: healthy controls; CFS: Chronic Fatigue Syndrome; ADHD: Attention Deficit Hyperactivity Disorder; N: Number; χ^2 : chi square value; df: Degrees of freedom; p: Probability value; Mdn: Median; IQR: Interquartile range.